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biodiverSity

of the

Indian River Lagoon

BULLETIN OF MARINE SCIENCE, 57(1): 1–7, 1995

INTRODUCTION

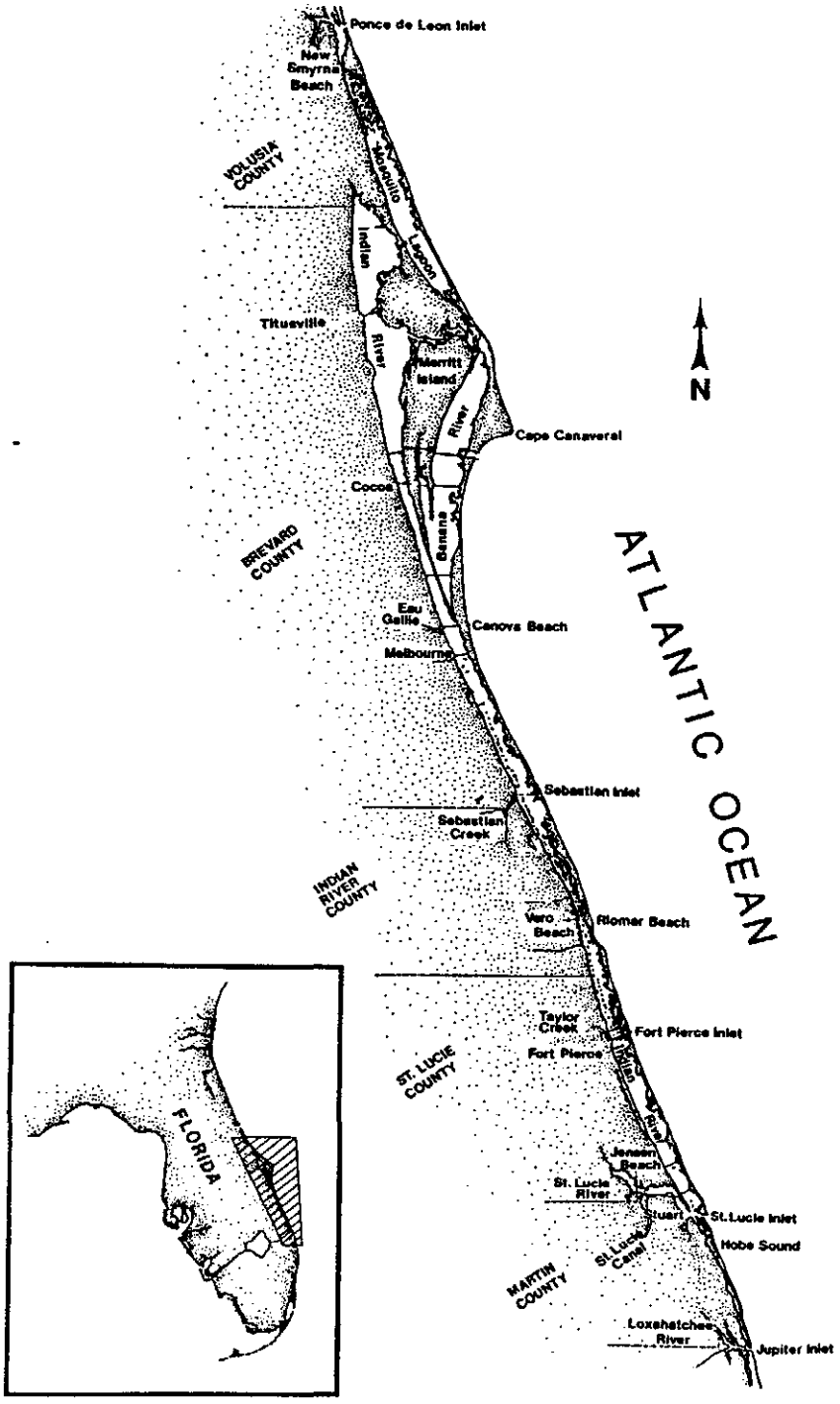
Hilary M. Swain, David R. Breininger, Derek S. Busby, Kerry B. Clark, Susan B. Cook, Robert A. Day, Duane E. De Freese, R. Grant Gilmore, Amy W. Hart, C. Ross Hinkle, Deborah A. McArdle, Paula M. Mikkelsen, Walter G. Nelson and Alyssa J. Zahorcak

Although the issue of planning for maintenance of biodiversity in terrestri communities has been considered widely by scientists and natural resource ma agers (Groombridge, 1992; Jensen, Torn and Harte, 1992; Noss and Cooperrid 1994) similar considerations in marine and estuarine systems have been mo limited (Ray and Grassle, 1991; Thorne-Miller and Catena, 1991; Norse, 199 Culotta, 1994). To date there have been no strategic plans developed to mana for biodiversity protection in any coastal estuary in the U.S. Developing a mod strategy for the protection of biodiversity requires an assimilation of existing da and synthesis of these data into management plans which address biodiversi concerns. The Indian River Lagoon in east central Florida is recognized as a estuary of high biological diversity (FDER, 1989) and would be an appropria candidate for such a model strategy.

The Indian River Lagoon runs for about one third of Florida's east coast, fro Ponce de Leon Inlet in the north to Jupiter Inlet in the south (Fig. 1). It is speci in that it is part of a subtropical barrier island complex which straddles a reco nized geographical boundary (Cape Canaveral) (Parr, 1933; Briggs, 1974). Gi more (1985) found that no other estuary in North America contained such a lar variety of plants and animals, and Kale (unpubl.) noted that it supports the mo diverse avifauna in the United States. This lagoonal biodiversity is, howeve currently under threat. The most recent analysis documents 75 species that a listed as in need of protection by state and federal agencies (Swain, 1995). Pr tecting the biodiversity of the Indian River Lagoon from the synergistic threa of habitat destruction, watershed alteration and a decline of water quality wi require some immediate measures (De Freese, 1991). Present obstacles to th development of a successful strategy to protect the lagoonal biodiversity includ lack of a comprehensive management plan, poor interagency coordination, si nificant gaps in basic research, and inadequate funding (De Freese, 1991).

Despite the importance of the biodiversity of the lagoon and the high level threats, the protection of biodiversity has not been a recognized management goa The "Biodiversity of the Indian River Lagoon Conference" was organized i response to the lack of management planning in this area. Planning for the co ference occurred throughout much of 1993 and the conference was held in the Seward Johnson Marine Education and Conference Center at Harbor Branc Oceanographic Institution, Fort Pierce, Florida, on February 15 and 16, 1994. Th members of the Organizing Committee, who are the authors of this introductio were an ad hoc advisory committee assembled by the National Estuary Progra (NEP), Indian River Lagoon. The committee represented a variety of academ specialists, researchers and managers, as well as intern support staff, interested i biodiversity topics in the lagoon.

The goal of the conference was to assemble and synthesize information on th current status of biodiversity in the lagoon. This synthesis will provide a fram work for the formation of management recommendations that are to be include


Ponce de Leon Inlet
New Smyrna Beach
VOLUSIA COUNTY
Mosquito Lagoon
Indian River
Titusville
Merritt Island
Cape Canaveral
Cocoa
Banana River
BREVARD COUNTY
Eau Gallie
Canova Beach
Melbourne
Sebastian Inlet
Sebastian Creek
INDIAN RIVER COUNTY
Vero Beach
Riomar Beach
Taylor Creek
Fort Pierce Inlet
Fort Pierce
ST. LUCIE COUNTY
Jensen Beach
St. Lucie River
Stuart
St. Lucie Inlet
Hobe Sound
St. Lucie Canal
MARTIN COUNTY
Loxahatchee River
Jupiter Inlet
ATLANTIC OCEAN
N
FLORIDA

in the Comprehensive Conservation Management Plan for the lagoon under prep aration by the NEP. The information collected will serve as a basis for the de velopment of management recommendations, including incorporation of nev techniques for conserving biodiversity, design of protected area networks, imple mentation of restoration techniques, development of a research agenda, identifi cation of further funding sources, definition of public policy issues and outlinin of educational needs. A subsidiary goal of the conference was to provide a effective transfer of information and knowledge from those involved in researc on the conservation of biodiversity in the lagoon to both general managers o marine ecosystems of Florida and to the general public. Participants at the con ference were asked to characterize biodiversity in the lagoon, identify its value document the threats, and review existing provisions for biodiversity protection.

First, each author was asked to address the current status of biodiversity, typ ically within a particular taxon or natural community, in terms of a series o questions. What was the original extent of biodiversity in the lagoon and how does it compare with the current extent? Do we know anything about the leve of genetic diversity in the lagoon? Have there been documented species extinc tions? To what extent are population sizes viable and are they increasing or de creasing? What is known about the level of endemism in the lagoon? Do life history strategies or autoecological parameters of any particular species assem blage render them rare in the lagoon or vulnerable to extinction processes? Are there any species with large aggregations, disturbance intolerance, or poor dis persal about which we should be concerned? What do we know about community structure and coevolutionary relationships in the lagoon? Where are the gaps in our knowledge of geographic distributions? Which species in the lagoon are year round residents versus migrants and vagrants? Which are the rare, threatened and endangered species in the lagoon and would any of these serve as keystone o indicator species?

Second, each author was asked to determine the nature and level of threats t biodiversity in the lagoon, again typically within a particular taxon or natura community. Several topics were outlined. What are the effects of deteriorating water quality such as light attenuation, nutrient loading, suspended sediments and other pollutants? Are there any potential consequences of ecosystem collapse, such as the disruption of salinity and tidal regimes, hydrological and fire pro cesses, and nutrient transport mechanisms? Does over-exploitation, either com mercial, recreational, accidental or by vandalism threaten any species? Are there any introduced species threatening the lagoon? What are the impacts of habitat loss, habitat fragmentation and isolation, and habitat degradation? Has habitat loss resulted in a significant breakdown of the lagoon's geographical context (the re lationship between uplands, estuarine waters, ocean and offshore systems and inlets)? Finally, what are the implications of any anticipated global change?

Two keynote speakers were invited to the conference to provide an international perspective to these questions. These were the presentations by Grassle and Norse. All the other papers focused on biodiversity in the Indian River Lagoon, although several were able to address this issue in a more regional context. The paper by Parkinson differed slightly from the general themes in that it discussed biodiversity in the Indian River Lagoon in a geological perspective. Table 1 tabulates the

←

Figure 1. Map of the Indian River Lagoon showing the location of the lagoon in Florida as well as major sections of the lagoon, the main cities, and the inlets (reprinted from Gilmore et al., 1981 with the authors' permission).

Table 1. Subject areas (status and degree of threat) addressed by speakers at the Biodiversity Conference. Authors are listed in the same order as in the publication. Presentations included as papers are listed first, followed by those included as abstracts.

		Status																Threats									
Authors	Taxonomic group/ natural communities/ subject area	International perspective	Regional perspective	Geological history	Genetics	Original extent	Extinctions	Population size	Endemism	Autoecology	Habitat	Distribution	Residency	Biogeography	Listed species	Indicator species	Keystone species	Water quality	Overexploitation	Exotic species	Disease	Disturbance	Habitat loss	Habitat fragmentation	Habitat degradation	Global change
Papers																											
Day	NEP perspective												✓									✓	✓	✓	✓	
Norse	International threats	✓									✓			✓					✓			✓				✓
De Freese	Regional perspective		✓																							
Parkinson	Geological history			✓		✓								✓								✓	✓	✓	✓	✓
Schmalzer	Saltmarsh/mangrove		✓			✓					✓	✓	✓	✓						✓		✓	✓	✓	✓	
Fletcher et al.	Seagrasses					✓					✓	✓				✓		✓								
Dawes et al.	Seagrasses					✓		✓			✓	✓	✓	✓		✓		✓				✓				
Virnstein	Seagrasses					✓					✓	✓	✓	✓		✓		✓				✓	✓			
Garland	Bacteria								✓			✓	✓													
Winston	Ectoprocts							✓			✓	✓	✓													
Mikkelsen et al.	Molluscs					✓	✓		✓		✓	✓	✓									✓				
Rice et al.	Sipunculans							✓			✓	✓	✓													
Kensley et al.	Isopods							✓			✓	✓	✓													
Nelson	Amphipods					✓		✓			✓	✓	✓			✓										
Clark	Opisthobranchs						✓	✓	✓		✓	✓	✓	✓	✓			✓				✓	✓		✓	
Gilmore	Fish							✓			✓	✓	✓	✓				✓				✓	✓		✓	
Tremain and Adams	Fish						✓				✓	✓	✓													
Lin and Beal	Fish/decapods							✓			✓	✓	✓									✓	✓			
Taylor et al.	*Rivulus marmoratus*						✓				✓	✓	✓													
Davis and Taylor	*Rivulus marmoratus*									✓	✓															
McMichaels et al.	Fish							✓				✓	✓													
Schikorr and Swain	Wading birds					✓		✓			✓	✓	✓		✓							✓				
Smith and	Wading birds					/		/			/	/	/		/											

Table 1. Continued

Authors	Taxonomic group/ natural communities/ subject area	Status																Threats								
		International perspective	Regional perspective	Geological history	Genetics	Original extent	Extinctions	Population size	Endemism	Autoecology	Habitat	Distribution	Residency	Biogeography	Listed species	Indicator species	Keystone species	Water quality	Overexploitation	Exotic species	Disease	Disturbance	Habitat loss	Habitat fragmentation	Habitat degradation	Global change
Abstracts																										
Hinkle	Regional perspective		✓								✓	✓										✓	✓		✓	
Grassle	Invertebrates	✓									✓	✓														
Niedoroda et al.	Physical processes		✓								✓			✓				✓				✓				
Buzas	Foraminifera											✓	✓			✓										
Young	Larval invertebrates						✓			✓		✓														
Fauchauld	Polychaetes										✓	✓	✓			✓										
Snelson et al.	Fish							✓			✓	✓	✓													
Adams and Tremain	Fish										✓	✓	✓													
Branstetter	Fish							✓				✓							✓			✓				
Shenker et al.	Tarpon							✓			✓	✓	✓													
Matheson and Gilmore	Mojarras							✓			✓	✓	✓													
Ehrhardt and Redfoot	Marine turtles					✓		✓	✓		✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
Morris and Nodine	Manatees					✓		✓			✓	✓	✓		✓			✓			✓					
Barros and Odell	Marine mammals							✓								✓		✓								
Ehrhardt	Terrestrial mammals					✓		✓	✓		✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
Mook	Fouling communities					✓					✓	✓	✓													
Renda et al.	Tidal communities										✓		✓													

extent to which speakers were able to address the questions outlined abov the taxonomic group or natural community they reviewed. Authors are the same order in which they appear in this volume to provide a quick r to taxa and topics of specific interest.

The 175 people who participated in the Biodiversity of the Indian River Conference enjoyed the opportunity to meet old friends and new colleague authors expressed enthusiasm for the opportunity to pull together unp data as well as thoughts and ideas about the lagoon that they had entertai the years. The sheer scale, diversity and depth of the material presented r an exciting and stimulating 2 days. This volume will hopefully serve as a s benchmark against which temporal changes can be evaluated, both for t tropical lagoonal system and for lagoonal systems in general. Since t planned as a mission-oriented conference, it is gratifying to realize the vc material assembled here for the National Estuary Program will play an role in the preparation of management recommendations and actions des improve the status of biodiversity in the Indian River Lagoon.

ACKNOWLEDGMENT

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